

REMARKS

Claims 2, 5, 12 and 13 have been rejected under 35 USC 103(a) as being unpatentable over JP '479 in view of Korea '067 and further in view of Mardilovich et al or Furusawa. Claims 6, 7 and 9-11 have been rejected under 35 USC 103(a) as being unpatentable over JP '479 in view of Korea '067 and further in view of either Mardilovich or Furusawa and further in view of Imori. Claim 8 has been rejected under 35 USC 103(a) as being unpatentable over JP '479 in view of Korea '067 and further in view of Imori and further in view of either Mardilovich or Furusawa. Claims 2 and 5-12 have been rejected on the ground of nonstatutory obviousness-type double patenting over Claims 1-14 of U.S. Patent No. 6 780 467 in view of JP '479 and Korea '067. Claims 2 and 5-12 have been rejected on the ground of nonstatutory obviousness-type double patenting over Claims 1-11 of U.S. Patent No. 7 045 461 in view of JP '479 and Korea '067. Claims 5, 12 and 13 have been rejected on the ground of nonstatutory obviousness-type double patenting over Claims 1-14 of U.S. Patent No. 7 179 741 in view of JP '479 and Korea '067. Claims 2 and 5-13 have been provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over Claims 4-15 of copending application Serial No. 10/558 172 in view of JP '479 and Korea '067. Claims 2 and 5-12 have been provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over Claims 1-10 of copending application Serial No. 10/586 379 in view of JP '479 and Korea '067. Claims 2 and 5-12 have been provisionally rejected on the ground of nonstatutory obviousness-type double patenting over Claims 1-11 of copending application No. 11/795 355 in view of JP '479. Claims 2 and 5-12 have been provisionally rejected on the ground of nonstatutory obviousness-type double patenting over Claims 5 and 6 of copending application Serial No. 10/576 230 in view of JP '479 and Korea '067. Claims 2 and 5-12 have

been provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over Claims 1-5 of copending application Serial No. 11/662 046 in view of JP '479 and Korea '067. Applicants once again respectfully traverse these grounds of rejection and urge reconsideration in light of the following comments.

As explained previously, the instant invention is directed to an ink composition used in an inkjet process for drawing a wiring pattern on a substrate in which the improvement comprises the ink composition contains from 0.01 to 100 g/L of an azole-based silane coupling agent as a coupling agent for an electroless plating activator. The ink composition of the present invention can uniformly form a wiring pattern having an excellent adhesion on a substrate and was arrived at through the discovery that an ink composition containing an azole-based silane coupling agent as a coupling agent for an electroless plating activator is unexpectedly effective in capturing the activator and adhering it to the substrate when applied by inkjet printing. The prior art cited by the Examiner does not teach the presently claimed invention.

JP '479 is directed to a method of drawing a wiring pattern on a substrate using an inkjet in which a composition containing a silane coupling agent is applied to the substrate in a pattern. The Examiner admits that this reference has no disclosure regarding the use of an azole-based silane coupling agent in the performance of electroless plating over the substrate. As such, the secondary Korea '067 must provide the motivation to one of ordinary skill in the art to modify JP '479 in a manner to yield the presently claimed invention. It is respectfully submitted that the secondary reference contains no such disclosure.

Korea '067 discloses an electroless metal plating method in which a silane-based coupling agent, which can be dissolved in a suitable solvent, is applied to a substrate, treated with a noble metal solution and then electrolessly plated to

provide a metal coating on the substrate. The silane coupling agent is desirably obtained by the reaction of an azole with an epoxy silane compound. There is no disclosure in this reference of the silane coupling agent being contained in an ink composition which is applied to a substrate by inkjet printing.

As pointed out in the previous Response, in order for an ink composition to be suitable for use in inkjet printing, it must be suitable for discharge from an inkjet nozzle and fixing on a substrate. There is no suggestion in Korea '067 that the azole-based silane coupling agent disclosed there would be suitable as an ink composition in JP '479 because there is no teaching that a mixture of an azole-based silane coupling agent in another composition would function as an ink composition in inkjet printing.

JP '479 requires that the silane coupling agent be heated and dried while, in the present invention, the heating process is not necessary. This allows the present invention to reduce the number of production steps and make the process for the manufacture thereof more economical. Additionally, the Examiner states in the outstanding Office Action that it would be obvious to modify the teaching of JP '479 to use an azole-based silane coupling agent as disclosed in Korea '067 with an expectation of desirable activation results. Applicants respectfully disagree.

As shown in the Example of JP '479, the nickel metal film formed by nickel plating after applying the solution containing  $\gamma$ -aminopropyl triethoxysilane to the substrate by inkjet printer was found to have a strong adhesion to the substrate by describing that there is no exfoliation observed in a peel-off test. On the other hand, Korea '067 discloses in Comparative Example 3 that nickel film formed by electroless nickel plating after the application of a solution containing  $\gamma$ -aminopropyl trimethoxysilane to a glass substrate only partially deposited thereon. By the way, the cited English translation of this reference is erroneous. The

Examiner is respectfully requested to review the corresponding International Application WO A12000001862. This teaching suggests that the nickel plating film formed following the treatment with the solution containing  $\gamma$ -aminopropyl trimethoxysilane was defective. Based on these two contradictions, it is not reasonable to infer that one of ordinary skill in the art would be motivated to change  $\gamma$ -aminopropyl triethoxysilane in JP '479 to the azole-based silane coupling agent of Korea '067.

Additionally, JP '479 discloses that the nickel plating is conducted at a rather high temperature of 90°C for 5 minutes. The deposited nickel film had a thickness of 2  $\mu\text{m}$  (paragraph [0047]) as opposed to the thin film of 0.5  $\mu\text{m}$  formed in the present invention. The test in the Example of the present application was conducted at a plating temperature of 70°C. This is based on the fact that the plating temperature of nickel electroless plating can be lowered to 70°C when a silane imidazole is used while absolutely no deposition of nickel film occurs at a temperature of 70°C when an amino-based silane coupling agent is used.

In the Example of JP '479, since the nickel plating was conducted at a high temperature of 90°C, the activity level of the electroless nickel plating is much higher than that for electroless copper plating and problems such as lowered palladium activation is not as important. Additionally, when performing electroless copper plating, the difference between the imidazole silane coupling agent and an amino-based silane coupling agent is more conspicuous.

As discussed in paragraph [0005] of the present specification, when an amino-based silane coupling agent is used, the adhesion on the activator is not uniform due to the distribution or concentration of the activator not being uniform. In JP '479, the plating was conducted at a high temperature of 90°C for 5 minutes which reduced the effect of low palladium activity. Additionally, the film thickness in this reference was 2  $\mu\text{m}$  which also diminished the problem of

the non-uniform distribution of the activator. This problem is significant when forming an electroless plating film according to the present invention having a sub-micron level thickness.

The plating temperature of the present invention is set to a practical operating temperature of 70°C while JP '479 required that the plating be conducted at a maximum plating temperature of 90°C to prevent boiling of the plating solution. Additionally, a very thin plating film which is drawn with an inkjet printer as disclosed in the present invention cannot be obtained using the amino-based silane coupling agent of Korea '067. As such, the present invention provides an unexpected benefit in that a very thin electroless plating film can be formed at lower temperature conditions.

As pointed out in the previous Response, objective test data is of record in the present application that is more than sufficient to establish the unobviousness thereof. In the Comparative Example contained in paragraph [0020] in the present specification,  $\gamma$ -aminopropyl trimethoxysilane was used in place of the reaction product of an imidazole and  $\gamma$ -glycidoxypipropyl trimethoxysilane. The  $\gamma$ -aminopropyl trimethoxysilane used in the Comparative Example corresponds very closely to the  $\gamma$ -aminopropyl triethoxysilane used in JP '479. The peel strength of the plating film obtained by using the ink composition of the Comparative Example was 1/5 of that of the ink compositions of Example 1 and 2 of the present invention. This 5-fold increase in peel strength of the presently claimed invention over the closest prior art is clearly unexpected and further establishes the patentability of the presently claimed invention thereover.

With respect to the numerous obviousness-type double patenting rejections made by the Examiner, the claims of the Imori patent only disclose a method of forming a metal plating on an article using a silane coupling agent. The claims of Imori et al '461 disclose a metal plating method and pretreatment agent comprising a silane coupling agent obtained

by reacting an imidazole-based compound and an epoxy silane-based compound. The claims of Imori '741 disclose an electroless metal plating method which utilizes a solution of a silane coupling agent which has an azole group. The claims of application Serial No. 10/558 172 disclose an electroless plating method which utilizes a silane coupling agent obtained by reacting an azole compound with an epoxy silane compound. The claims of application Serial No. 10/586 379 disclose a pretreating agent which can comprise a silane coupling agent obtained by reacting an azole compound or amine compound with an epoxy silane compound. The claims of application Serial No. 11/795 355 disclose a resin substrate material having a surface that is swellable in a solution containing an imidazole silane and a noble metal compound. The claims of application Serial No. 10/576 230 are directed to an electroless copper plating method which can use a pretreatment agent prepared by reacting a noble metal compound and a silane coupling agent having a functional group with metal capturing capability. The claims of application Serial No. 11/662 046 disclose an electroless plating pretreatment agent comprising a thermoset resin and a silane coupling agent having a metal-capturing capability. None of these references disclose that an azole-based silane coupling agent can be used in an ink composition which is applied to a substrate by inkjet printing. Therefore, these references are no more relevant than KR '067 with respect to the disclosure of the presently claimed invention.

As pointed out previously, JP '479 only discloses a silane coupling agent used in an inkjet process but, as shown by the comparative test data contained in the present specification, the azole-based silane coupling agent of the present invention provides an unexpectedly superior peel strength to the ink composition as compared to the silane coupling agent disclosed in JP '479. As such, assuming for arguments sake that any of the references combined with JP '479 presents a showing of *prima facie* obviousness under 35

USC 103(a), the objective evidence of unobviousness present in the instant specification is more than sufficient to rebut any rejection made under 35 USC 103(a) of the presently claimed invention.

The Examiner is respectfully requested to reconsider the present application and to pass it to issue.

Respectfully submitted,



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